

Notice of Allowability	Application No.	Applicant(s)	
	10/671,329	HERR ET AL.	
	Examiner	Art Unit	
	HIBA EL-KAISSI	3762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendment filed on 09/12/2011.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-11, 13-15, 19-29, 31-41.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date ____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. <input type="checkbox"/> Notice of References Cited (PTO-892) 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>09/14/2011</u> 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material | <ol style="list-style-type: none"> 5. <input type="checkbox"/> Notice of Informal Patent Application 6. <input checked="" type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date <u>09/14/2011</u>. 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance 9. <input type="checkbox"/> Other ____. |
|--|---|

/Niketa I. Patel/
Supervisory Patent Examiner, Art Unit 3762

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Scott Pierce on 09/14/2011.

The application has been amended as follows:

2. Please replace claims 1-3, 25, 26, 31, 37, 38 and 40 with the following claims respectively.

Claim 1:

A variable-impedance active ankle foot orthosis comprising:

- a) an actuator configured to support a human ankle joint;
- b) at least one of an ankle angle sensor and a ground reaction force sensor; and
- c) a computer controller linked to the actuator and the sensor, the computer controller configured to receive sensory information from the at least one sensor and configured to modulate, in an updating manner, impedance of the actuator in response to at least one signal from the sensor, thereby modulating, by computer-controlled actuation, impedance of the human ankle joint, including a joint stiffness or damping of the ankle joint, from step-to-step of a walk cycle for treating an ankle foot gait pathology.

Claim 2:

The device of Claim 1, wherein the actuator includes a torsional spring control component that is configured to modulate impedance of the ankle joint.

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Claim 3:

The device of Claim 1, wherein the actuator includes a spring-damper control component that is configured to modulate impedance of the ankle joint.

Claim 25:

A variable-impedance active ankle foot orthosis, comprising:

- a) an actuator that includes a spring, wherein the actuator is configured to support a human ankle joint;
- b) at least one of an ankle angle sensor and ground reaction force sensor; and
- c) a computer controller linked to the actuator and the sensor, the actuator configured to receive sensory information from the at least one sensor and to modulate impedance, including a joint stiffness or damping of an ankle joint, by controlling compression of the spring in response to the sensory information comprising at least one of an ankle angle and a ground reaction force, the actuator modulating the joint stiffness or damping of the ankle joint by controlling the spring in an updating manner from step-to-step of a walk cycle in response to the at least one of ankle angle and ground reaction force.

Claim 26:

The variable-impedance active ankle foot orthosis of Claim 1, wherein the actuator includes a DC motor and a spring, wherein the DC motor is connected in series with the spring, whereby the actuator is configured to modulate the joint stiffness or damping of the ankle joint.

Claim 32:

The method of Claim 19, wherein the modulation is in response to a ground reaction force sensor signal from the ground reaction force sensor during walking.

Claim 37:

A variable impedance active ankle foot orthosis comprising:

- a) an actuator configured to support a human ankle joint;
- b) at least one of a ground reaction force sensor and an ankle angle sensor; and
- c) a computer controller linked to the actuator and to the sensor,

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wherein the orthosis is configured to receive sensory information from the at least one sensor and configured to modulate, by computer-controlled actuation, ankle joint impedance, including a joint stiffness or damping of an ankle joint, wherein modulation of the joint impedance is adaptive in nature.

Claim 38:

A device for treating an ankle foot gait pathology comprising:

an orthosis including an orthosis leg portion configured to be attachable to a leg of a person and an orthosis foot portion configured to be attachable to a foot of the person; and

an actuator configured to act on a spring;

at least one of an ankle angle sensor and a ground reaction force sensor;
and

a computer controller linked to the actuator and the sensor, the computer controller configured to receive sensory information from the at least one sensor and configured to modulate by computer-controlled actuation, impedance, including joint stiffness or damping of the ankle joint, wherein modulation of joint impedance is adaptive in nature.

Claim 40:

A variable impedance active ankle foot orthosis comprising:

a) an actuator and a spring operatively linked to the actuator

b) an ankle angle sensor;

c) a ground force reaction sensor; and

d) a controller linked to the sensors and to the actuator, wherein the actuator is configured to receive sensory information from the at least two sensors and configured to modulate, by computer-controlled actuation, impedance, including a joint stiffness or damping of an ankle joint, by controlling compression of the spring, in response to the two sensors during walking, the actuator modulating the joint stiffness or damping of the ankle joint, wherein modulation of joint impedance is adaptive in nature.

REASONS FOR ALLOWANCE

3. The following is an examiner's statement of reasons for allowance:

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Regarding the independent claims, the subject matter not found or suggested in the prior art is an ankle angle sensor and a ground reaction force sensor, and a computer controller configured to modulate, in an updating manner, impedance of the actuator in response to the sensor signals, including joint stiffness or damping from step to step, in combination with the rest of the elements in the claim. The closest prior art, Beard, does not disclose or suggest modulating stiffness or damping of the ankle joint, by modulating impedance in an updating manner, by computer controlled actuation. Beard however discloses a biofeedback activated orthosis for foot-drop rehabilitation, including a device for sensing a signal to a controller representing angular relationship between the lower leg and the thigh, and not a variable impedance orthosis, and does not modulate impedance based on ankle angle and ground reaction force sensor signals.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to HIBA EL-KAISSI whose telephone number is (571)270-5617. The examiner can normally be reached on Monday- Friday 9 a.m - 6 p.m.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Niketa Patel can be reached on (571)272-4156. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/HIBA EL-KAISSI/
Examiner, Art Unit 3762

/Niketa I. Patel/

Supervisory Patent Examiner, Art Unit 3762